

VSS144

Green Racing Protocols & Technology Applications

Principal Investigator(s):

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**2014 U.S. DOE Hydrogen Program and
Vehicle Technologies Program Annual
Merit Review and Peer Evaluation
Meeting**



OVERVIEW

Timeline

- Project start date: Oct. 2013
- Project end date: Sept. 2016

Barriers*

- Risk aversion
- Cost : impacts of advanced technology/fuels

**from 2011-2015 VTP MYPP*

Budget (DOE share)

- FY14 funding:
 - DOE VSST \$350k
- FY15 funding: \$450k

Partners

- U. S. EPA
- SAE International
- Oak Ridge National Laboratory
- Bioenergy Technologies Office (BETO)
- Argonne National Laboratory
- The International Motor Sports Association (IMSA)

OBJECTIVE: Align Advanced Transportation Technologies and Fuels with Motorsports in North America

“WHY”

- **Generally vehicle consumers are relatively risk adverse to adoption of advanced technologies on major purchases**
- **The motorsports fan base has millions of light duty vehicle drivers and potential vehicle purchasers who observe racing to receive vehicle technology updates**
- **Outreach opportunities for racing fans are compounded with the connection to Green Racing Partners**
- **Political challenges for bio-fuels can cast a cloud over the potential benefits for advanced fuels**

“HOW”

- **Release of the newly revised Green Racing Protocols within the partner relationships**
 - Recognize commitment levels with objective rating system Green Racing Commitment Matrix (GRCM)
 - Expand the sanctioning body partnership opportunities thru application of the GRCM
 - Develop review/approval process for Green Racing recognition applications thru SAE partnership
- **Evaluate/Propose the merits of specific alternative technologies/fuels**
 - OEM interaction for assessment of planned technology and fuel opportunities
 - Mid-blend bio fuels incorporation summary information and presentation materials
 - Flywheel mechanical energy storage device evaluation
- **Showcase Green Racing initiatives and mission**
 - Represent Green Racing working group at various events and workshops
 - Campaign the Green Racing Simulator (GRS) at specified events
 - Re-launch of GreenRacingCup.org outreach website

RELEVANCE*

- **Supports DOE Vehicle Technology Program (VTP) strategy missions:**
 - Assist in the deployment of more energy-efficient and environmentally friendly technologies



- **Directly supports 2 VTP cross-cutting activities:**
 - Consumer outreach and education
 - Partnership development
- **Addresses the following VSST Barriers:**
 - **Risk aversion:** Provides consumer base with direct OEM connection to development process as well as performance evaluation of advanced technology and alternative fuels in a competition environment.
 - **Cost:** Provide guidance to obtain opportunities for effective use of advanced technologies and Bio-fuels thru Government support channels and established partner relationships

*Reference: Vehicle Technologies Multi-Year Program Plan 2011-2015:

http://www1.eere.energy.gov/vehiclesandfuels/pdfs/program/vt_mypp_2011-2015.pdf

APPROACH: Seize Opportunity, Be Objective and Extend thru Outreach

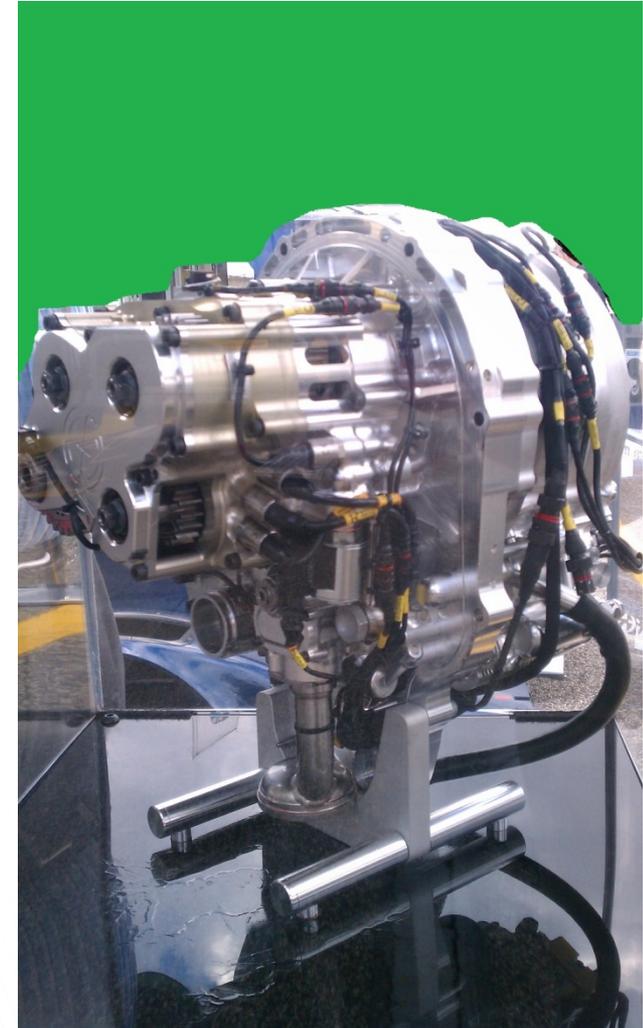
Dyson Racing

Flybrid Technologies

Iso-Butanol powered mechanical flywheel prototype



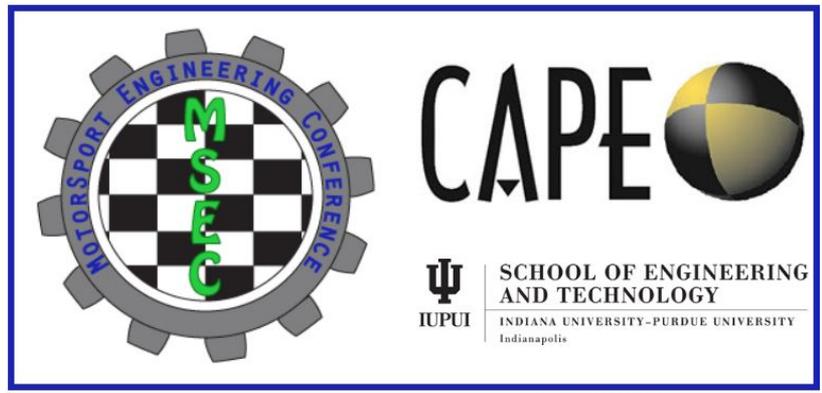
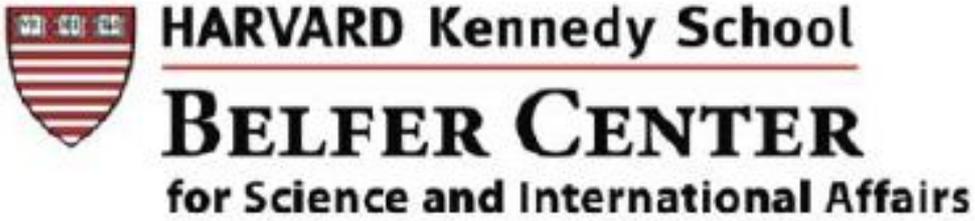
<http://www.motorsport.com/alms/news/dyson-racing-to-run-flybrid-kers-hybrid-system-at-vir/>



APPROACH: Seize Opportunity, Be Objective and Extend thru Outreach



SURFACE VEHICLE RECOMMENDED PRACTICE	J2880	JUN2014
	Issued 2008-10 Revised 2014-06	
Superseding J2880 OCT2008		
(R) Recommended Green Racing Protocols		



APPROACH: Seize Opportunity, Be Objective and Extend thru Outreach

The Green Racing Simulator



Green Racing Simulator participants from various backgrounds

APPROACH: Seize Opportunity, Be Objective and Extend thru Outreach



FY2015 MILESTONES

Month /Year	Milestone or Go/No-Go Decision	Description	Status
Jun 2014	Milestone	Successful ballot of revised SAE J2880 “Recommended Green Racing Protocols”	COMPLETE
Dec 2014	Milestone	Completion of application submission and review process	COMPLETE
March 2015	Milestone	Return Green Racing Simulator to outreach campaign	On-going
Sept 2015	Milestone	Expand Green Racing partnership to include new sanctioning body	ON SCHEDULE

ACCOMPLISHMENT (1): New J2880 Green Racing Protocols Published



SURFACE VEHICLE RECOMMENDED PRACTICE	J2880	JUN2014
	Issued	2008-10
	Revised	2014-06
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(R) Recommended Green Racing Protocols		

Fuels	GHG Well-to-Pump (WTP)	GHG Pump-to-Wheels (PTW)	GHG Well-to-Wheels	Oil Use WTP	Oil Use PTW	Oil Use Well-to-Wheels
	gms CO ₂ -Equivalent/MJ	gms CO ₂ -Equivalent/MJ	gms CO ₂ -Equivalent/MJ	MJ Oil/MJ Fuel	MJ Oil/MJ Fuel	MJ Oil/MJ Fuel
Unleaded Gasoline	18.2	74.9	93.2	0.1071	1.0	1.1071
Corn Ethanol	1.1	72.2	73.3	0.0477	Fraction of oil feedstock in fuel	Sum of WTP and PTW Oil Use
Cellulosic Ethanol	-65.1	72.2	7.1	0.0262	Fraction of oil feedstock in fuel	Sum of WTP and PTW Oil Use
Ultra-Low Sulfur Diesel	17.1	74.9	92.0	0.0986	1.0	1.0986
Gas-to-Liquids Diesel Non-North American Natural Gas	40.7	72.4	113.1	0.0211	Fraction of oil feedstock in fuel	Sum of WTP and PTW Oil Use
Biomass-to-Liquids Diesel Hydrogenated Vegetable Oil	-27.4	73.3	46.0	0.0698	Fraction of oil feedstock in fuel	Sum of WTP and PTW Oil Use
Normal Iso-Butanol	-5.9	70.1	64.2	0.0433	Fraction of oil feedstock in fuel	Sum of WTP and PTW Oil Use

ACCOMPLISHMENT (1): New J2880 Green Racing Protocols Objective

Recognition Levels

		Commitment		Level	
Green Racing Element	Core	Enhanced	Elevated	Pinnacle	
	Green Racing Points	Green Racing Points	Green Racing Points	Green Racing Points	Green Racing Points
Propulsion Systems	SI engines with 10% or more renewable fuels content <i>or</i> diesel engines only	SI engines with 10% or more renewable fuels content <i>and</i> diesel engines allowed	Enhanced <i>and/or</i> electric drive <i>and/or</i> natural gas prime mover	Elevated <i>and</i> plug-in powertrains <i>and/or</i> fuel cells <i>or</i> unforeseen innovation	
	1	4	6	8	
Fuels/Energy Carriers	A 10% reduction in WTW oil use over baseline of no renewable fuels	A 20% reduction in WTW oil use over baseline of no renewable fuels	A 30% reduction in WTW oil use over baseline of no renewable fuels <i>or</i> electricity for PHEVs <i>and/or</i> a gaseous fuel	A 50% reduction in WTW oil use over baseline of no renewable fuels <i>or</i> a mix of renewable fuels with a gaseous fuel <i>or</i> electricity as the only fuel <i>or</i> unforeseen innovation	
	1	2	3	4	
Energy Recovery	Use of waste heat for engine performance enhancement (e.g. turbochargers or bottoming cycle systems)	Kinetic energy recovery for propulsion <i>and</i> energy storage limited by energy capacity <i>and</i> limits on Energy Storage System replacement during the season	Enhanced but with energy storage for hybrid electric vehicles limited by useable power <i>and/or</i> waste energy recovery for auxiliary loads or propulsion <i>and/or</i> hydraulic or pneumatic energy storage	Elevated <i>and</i> open energy storage limited by mass only <i>or</i> unforeseen innovation	
	1	4	6	8	

ACCOMPLISHMENT (1): New J2880 Green Racing Protocols Objective Recognition Levels

		Commitment		Level				
Green Racing Element	Core	Enhanced	Elevated	Pinnacle				
	Green Racing Points	Green Racing Points	Green Racing Points	Green Racing Points				
Improving Efficiency	Fuel use measurement <i>and</i> intake air restriction <i>and</i> traditional sporting regulations with mass and aero drag additions to balance performance	1	Core <i>and</i> energy recovery for auxiliaries or propulsion <i>and/or</i> mass and aero drag <i>reductions</i> to balance performance where possible	2	Enhanced <i>and</i> fuel flow limits replace air restrictors <i>and/or</i> 15% reduction in tire use over the season from 2010 baseline	3	Elevated <i>and</i> energy allocations <i>and/or</i> 30% reduction in tire use over the season from 2010 baseline <i>or</i> electric drive only <i>or</i> unforeseen innovation	4
	Fuel use measurement <i>and</i> no visible exhaust smoke <i>and</i> 10% reduction in WTW GHG over baseline of no renewable fuels <i>and</i> amateurs retain PCV, OEM catalysts and closed-loop control	1	Core <i>and</i> 20% reduction in WTW GHG over baseline of no renewable fuels <i>and</i> periodic air quality monitoring in dense spectator area(s)	2	Enhanced <i>with</i> 30% WTW GHG reductions over baseline of no renewable fuels	3	Enhanced <i>with</i> 50% WTW GHG reduction over baseline of no renewable fuels <i>or</i> unforeseen innovation	4

ACCOMPLISHMENT (2): Cellulosic Ethanol Supply for IMSA

- INEOS Ethanol Supplier to VP Racing fuels



BETO Director - Jonathan Male checking inventory at race event

COLLABORATION AND COORDINATION

- **The International Motor Sports Association (IMSA)**

- Collaboration between IMSA and Green Racing Initiative partners stems back to 2008 with a revised MOU signed in 2014.
- New application for recognition of commitment from IMSA received in May 2015



- **EPA**

- Media support and coordination of outreach
- Technical support relating to fuel pathways and GHG calculation reductions (RFS)
- On-site support during Green Racing events



- **SAE International**

- SAE protocols development support
 - Facilitation of meetings
 - SAE site storage information and working group coordination
- On-site support during Green Racing events



- **Argonne National Laboratory**

- Provides assistance and logistics with the Green Racing simulator outreach trailer



- **Related ORNL Activities**

- Coordination with FEERC and bio-fuels related information leading to fuel supplier and bio content guidance for future competition fuels
- Flywheel component modeling effort started as GR evaluation project



PROPOSED FUTURE WORK

- **FY2015**

- Complete outreach campaign sites for Green Racing Simulator
- Baseline mid-blends biofuels testing coordinated with IMSA
- Completion of agreement for additional racing series into Green Racing framework

- **FY2016**

- International series recognition for North American events performed in alignment with J2880
- Fuel measurement comparison study
 - Actual track fuel usage data compared to metered data and to projected power required
- Guidance document incorporating hybrid technologies into partner regulations

SUMMARY:

- **Relevance**
 - **Deployment of advanced vehicle technologies/fuels** in open public competition
 - **Providing guidance** towards strategic fuels and relevant technologies for inclusion into motorsports
- **Approach**
 - **Multi-faceted approach** to balancing GHG reduction strategies with technology opportunities in motorsports events by building partnerships,
- **Technical accomplishments and progress**
 - **Established industry support** for objective measure of commitment in SAE J2880
 - **Established reference component model** for alternative energy storage device
- **Outreach accomplishments and progress**
 - **Re-Launched** Green Racing Cup website and placed Green Racing Simulator (GRS) back into operation
 - **Aligned GRS** with planned events for rest of FY
- **Collaborations**
 - **Industry:** The International Motor Sports Association (IMSA), SAE International
 - **Government:** U.S. EPA, Argonne National Laboratory, Oak Ridge National Laboratory
- **Proposed Future Work**
 - Complete **baseline modeling tasks** (mechanical energy storage components and validate with technology partner)
 - **Future Competition Fuels testing:** attempt to align motorsports with strategic fuel from Engine/Fuels Optima

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